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(71) Applicant and
(72) Inventor: LEE, Joong-Ho [KR/KR]; 334-18, Gaebong3-dong, Guro-gu, 152-814 Seoul (KR).

(74) Agent: LEE, Young-Pil; The Cheonghwa Building, 1571-18, Seocho-dong Seocho-gu, 137-874 Seoul (KR).

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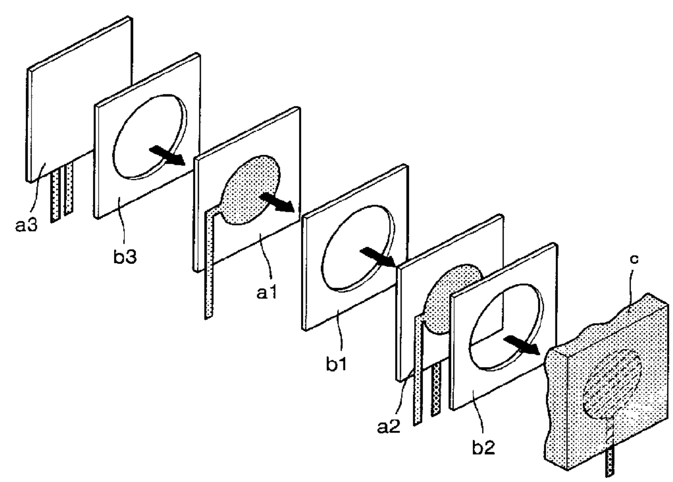
(54) **Title:** THE ACCELERATION SENSING MOTION SENSOR AND METHOD FOR SENSING THEREOF



(57) **Abstract:** Provided are an acceleration sensing motion sensor that senses acceleration caused by the movement of a moving object, a human being, or an animal, and generates a signal, and a method using the same. This sensor includes a first plate, first through fifth thin films, and a piezoelectric layer. The method includes the steps of; installing a motion sensor; sensing an acceleration signal and transmitting the same by wireless; receiving and recording the wirelessly transmitted acceleration signal every hour; determining a basic pattern of the movement; fixing a motion sensor on a major body region of a user; recording an acceleration signal with respect to the movement of the user; comparing the movement of a model with the movement of the user and analyzing a difference between the movements; and correcting the movement or posture of the user or determining a part to be corrected. A thin layer is formed on each side of the polyhedral case thus detecting acceleration in all directions.

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THE ACCELERATION SENSING MOTION SENSOR AND METHOD FOR SENSING THEREOF

Technical Field

The present invention relates to an acceleration sensing motion sensor and a method of using the same, and more particularly, to an acceleration sensing motion sensor (hereinafter, referred to as a 'motion sensor') that senses acceleration generated by the movement of a human body, an animal, or a moving object, and produces an acceleration signal, and a method of using the same.

Background Art

In general, an outer device, such an optical sensor or a closed circuit TV (CCTV), is required to sense the movement of a moving object, e.g., a human body or an animal, and control or simulate the movement of different kinds of apparatuses, using the sensed movement. When a person passes through a predetermined point, the optical sensor senses the person's movement, sends a control signal to the CCTV, and the CCTV starts recording and analyzing the person's movement. However, such apparatuses are disadvantageous in that they are difficult to be installed and can be used only in limited places. To solve these problems, it is suggested that a sensor be attached directly to main parts of a human body. However, this method is not preferred, because the sensor is also difficult to be attached to a human body due to its complicated and voluminous structure. Further, the sensor is expensive, and it is difficult to transmit data by wireless, using the sensor. In addition, the operation of the sensor would often be interfered by magnetic fields, and the free movement of a person who wears the sensor is restricted due to the size and weight of the sensor.

Meanwhile, the use of a sensing apparatus, which generates a signal in response to the movement of a human body, is required in a device that produces music in accordance with the movement of a human body, using a musical instrument digital interface (MIDI) which is an international standard of exchanging data between electronic musical instruments. Such a sensing apparatus is also included in arcade game machines for executing popular arcade games that are virtual reality-based games, and in which the movements of game characters are controlled by a user's manipulation. However, the existing sensing apparatuses have the above presented disadvantages.

Disclosure of the Invention

To solve the above-described problems, it is a first object of the present invention to provide a motion sensor in a polyhedral configuration, whose shape and size can be easily adjusted to precisely detect an acceleration motion of a user.

It is a second object of the present invention to provide an acceleration sensing method that has such a compact and simple structure that it can be easily fixed on a human body, its installation is not restricted by place and ambient conditions because of its capability of wireless data transmission, and it has such excellent sensitivity that it can be applied to various fields as well as the existing motion capture field.

To achieve one aspect of the above objects, there is provided an acceleration sensing apparatus including a polyhedral case having a steel ball therein, the apparatus including a first plate forming an outer side of the polyhedral case, the first plate whose inside is covered with a conductive material connected to the outside; a first thin film positioned on the inside of the first plate, having a right side coated with a conductive material, and connected to the outside of the case by wire; a

second thin film positioned at the right side of the first thin film and having a hollow center; a third thin film positioned at the right side of the second thin film, having both sides coated with a conductive material, and connected to the outside of the case by wire; a fourth thin film positioned at the right side of the third thin film and having a hollow center; a piezoelectric thin film positioned at the inside of the first plate and formed of a thin piezoelectric element; and a fifth thin film positioned at the right side of the piezoelectric thin film and having a hollow center.

Preferably, at least one conductive material-coated thin film group having the first through third thin films.

Preferably, the conductive material-coated thin film group is arranged such that the first through third thin films overlap at least once.

Preferably, the apparatus includes one piezoelectric thin film group having the piezoelectric film and the fifth thin film.

Preferably, the piezoelectric device thin film group is arranged such that the piezoelectric film and the fifth thin film overlap at least once.

Preferably, the apparatus includes one of the conductive material-coated thin film group and the piezoelectric device thin film that can be attached to every side of a polyhedron.

Preferably, the hollow centers of the second, fourth, and fifth thin films may be of to various shapes.

Preferably, the conductive material-coated thin film group and the piezoelectric device thin film group are in an on/off-state or generate electric signals like voltage when surface pressure by the movement of the steel ball is applied to the groups.

Preferably, the polyhedral case may be a tetrahedron, a hexahedron, or an octahedron.

Preferably, the shape of the steel ball may be spherical, oval, or polyhedral.

Preferably, the motion sensor comprises a mercury switch that is a bar-shaped tube or a polyhedral tube having at least two terminals.

To achieve another aspect of the above objects, there is provided an acceleration sensing method including fixing a motion sensor on a major body region of a model; sensing an acceleration signal with respect to the movement of the model, using the motion sensor, and wirelessly transmitting the sensed acceleration signal; receiving and recording the wirelessly transmitted acceleration signal every hour; analyzing the recorded acceleration signal and determining a basic pattern of the movement of the model; fixing a motion sensor on a major body region of a user; receiving and recording an acceleration signal with respect to the movement of the user; comparing the movement of the model with the movement of the user and analyzing a difference between the movements; and determining and correcting the movement or posture of the user according to the comparison result.

To achieve still another aspect of the above objects, there is provided an acceleration sensing method including fixing a motion sensor on a major body region of a user; sensing an acceleration signal with respect to the movement of the user and wirelessly transmitting the sensed acceleration signal; receiving the wirelessly transmitted acceleration signal, generating a musical instrument digital interface (MIDI) protocol corresponding to the acceleration signal, producing a game system play control signal, and producing an illuminating/electronic apparatus control signal; and producing a MIDI electronic sound, or actuating a game system, or an illuminating/electronic apparatus in response to the produced control signal.

Brief Description of the Drawings

The above objects and advantages of the present invention will become more apparent by describing in detail preferred embodiments thereof with reference to the attached drawings in which:

FIG. 1 is a view of a motion sensor according to the present invention;

FIG. 2 is a view of the structure of the motion sensor shown in FIG. 1;

FIG. 3 is a circuit diagram of a motion sensor according to the present invention;

FIG. 4 illustrates the operational principles of a motion sensor according to the present invention;

FIG. 5 is a view of the exterior of an acceleration sensing apparatus consisting of dual conductive material-coated thin film groups, in which a motion sensor is in a stop phase;

FIG. 6 is a view of the exterior of an acceleration sensing apparatus consisting of dual conductive material-coated thin film groups, in which a regular acceleration is applied to a motion sensor or a magnetic force is applied to a steel ball by a magnetic field;

FIG. 7 is a view of the exterior of an acceleration sensing apparatus in which a greater force than in the acceleration sensing apparatus FIG. 6 is applied to a motion sensor;

FIGS. 8 and 9 are views illustrating an acceleration sensing apparatus consisting of one piezoelectric thin film group, in which an acceleration signal is generated due to surface pressure applied onto a steel ball;

FIG. 10 is a flowchart illustrating one embodiment of an acceleration sensing method according to the present invention, using the motion sensor of FIG. 1; and

FIG. 11 is a flowchart illustrating another embodiment of an acceleration sensing method according to the present invention, using the motion sensor of FIG. 1.

Best mode for carrying out the Invention

FIG. 1 is a view of a motion sensor according to the present invention, and FIG. 2 is a view of the structure of the motion sensor of FIG. 1.

Referring to FIG. 1, the motion sensor includes a polyhedral case A having a steel ball B therein. Here, the polyhedral case A may be of various shapes, e.g., a tetrahedron, a hexahedron, and an octahedron. As shown in FIG. 2, the inside of the polyhedral case *A* consists of a first plate C, first through fifth thin films a1, b1, a2, b2, and b3, and a piezoelectric film a3.

The first plate C forms the right outer side of the polyhedral case A having the steel ball B and has an inner side coated with a conductive material connected with the outside. The first thin film a1, which is a thin film, is formed on the inside of the place C and its right side is coated with a conductive material connected with a downward wire. The second thin film b1, which is also a thin film, is formed at the right side of the first thin film a1 and has a hollow center. The third thin film a2, which is a thin film, is formed at the right side of the second thin film b1 and has both sides, each of which is coated with a conductive material that is connected to a downward wire. The fourth thin film b2, which is a thin film, is formed at the right side of the third thin film a2 and has a hollow center. The piezoelectric film a3 is a thin film piezoelectric device that is formed on the inside of the first plate C and generates a voltage signal when a surface pressure is applied thereto. The fifth thin film b3 is a thin film formed at the right side of the piezoelectric film a3 and has a hollow center.

These films are classified into several groups as follows:

(a) first conductive material-coated thin film group: the first thin film a1, the second thin film b1, and the third thin film a2 (having its left side coated with a conductive material);

(b) second conductive material-coated thin film group: the third thin film a2 (having its right side coated with a conductive material), the fourth thin film b2, and the first plate C; and

(c) piezoelectric thin film group: the piezoelectric film a3, and the fifth thin film b3.

In conclusion, as shown in FIG. 2, a motion sensor according to the present invention includes the polyhedral case A having the steel ball B therein, and having two-phase conductive material-coated thin film groups and one-phase piezoelectric device thin film group at its right side. That is, dual conductive material-coated thin film groups and one piezoelectric device thin film group are overlapped and attached to the right side of the polyhedral case A.However, the structure of a motion sensor according to the present invention is not restricted to the above configuration. For instance, it is possible to manufacture the motion sensor with at least one conductive material-coated thin film group or at least one piezoelectric thin film group. Otherwise, the motion sensor may be manufactured by arranging one of or both the first conductive material-coated thin film group and the second conductive material-coated thin film group.

Meanwhile, a motion sensor according to the present invention may be replaced with a mercury switch in which mercury in a glass tube controls the connection or disconnection of a terminal. In the operation of the mercury switch, mercury moves in the glass and is connected to the terminal according to acceleration. The existing single tube type mercury switch having one terminal senses acceleration in one direction, whereas a mercury switch according to the present invention may be

fabricated as the single tube type mercury switch, or a polyhedral mercury switch tube having at least two terminals that can sense acceleration in all directions.

FIG. 3 is a circuit diagram of a motion sensor according to the present invention. Referring to FIG. 3, N_1 denotes a conductive material coated on the right side of the first thin film a1, N_2 denotes a conductive material coated on the left side of the third thin film a2, N_3 denotes a conductive material coated on the right side of the third thin film a2, N_4 denotes a conductive material coated on the inside of the first plate B, and N_5 and N_6 denote a pair of wires attached to one side of the piezoelectric film a3.

FIGS. 4(a) and (b) illustrate the operational principles of a motion sensor according to the present invention, and more particularly, components of acceleration generated when a motion sensor according to the present invention moves to a certain point. When the motion sensor moves with acceleration having the intensity **a** in the direction of **a**, a steel ball B in the polyhedral case A moves with acceleration having the intensity **a** but in the opposite direction of **a**, according to the law of action and reaction. As a result, compression surface pressure from the steel ball B is applied to the internal sides of the polyhedral case A. The given surface pressure is divided into rectangular components and perpendicularly applied onto the respective sides of the polyhedral case A. The acceleration is calculated by the following equation:

$$\mathbf{a} = a_x i + a_y j \quad a_z k \qquad \ldots (1)$$

wherein a_x denotes the scalar component of the acceleration of vector in the i direction, which is applied along the x-axis sides of the polyhedral case A, a_y denotes the scalar component of the acceleration of vector in the j direction, which is applied along the y-axis sides, and a_z

denotes the scalar component of the acceleration of vector in the k direction, which is applied along the z-axis sides. Here, surface pressure given on each side is calculated by multiplying a related acceleration component by the mass of the steel ball B. Accordingly, the motion sensor according to the present invention can indicate the movement of a moving object as a signal with acceleration signals sensed by the respective sides.

FIG. 5 is a view of the exterior of an acceleration sensing apparatus made of a dual conductive material-coated thin film group, in which a motion sensor is in a stop motion. More specifically, in the acceleration sensing apparatus, the first thin film a1 does not contact the third thin film a2 and a switch N_1-N_2 is in an off state.

FIG. 6 is a view of the exterior of an acceleration sensing apparatus made of a dual conductive material-coated thin film group, in which a regular acceleration is applied to a motion sensor or a magnetic force is applied to the steel ball B by a magnetic field. In this case, surface pressure corresponding to the movement of an object is transferred from the steel ball B to the first thin film a1. As a result, the first thin film a1 is pressed to contact the third thin film a2, thereby causing the switch N_1-N_2 into an on state.

FIG. 7 is a view of the exterior of an acceleration sensing apparatus made of a dual conductive material-coated thin film group, in which a greater acceleration than that in FIG. 6 is applied to a motion sensor according to the present invention. Referring to FIG. 7, two conductive material-coated thin film groups transform elastically due to surface pressure provided by the steel ball B, thus turning on two switches N_1-N_2 and N_3-N_4.

The following Table 1 shows the operations of two hexahedron motion sensors, each side of which consists of a triple conductive material-coated thin film group having a three-phase switching function.

From the Table 1, it is noted that at a certain point of time these two motion sensors generate signals representing the acceleration of a moving object.

[Table 1]

Motion Sensor No/Position	Polyhedron Side No.	Switching Level	State	Motion Sensor No./Position	Polyhedron Side No.	Switching Level	State
First Motion Sensor (right/wrist)	1	N1	On	Second Motion Sensor (left/ankle)	1	N1	Off
		N2	On			N2	Off
		N3	Off			N3	Off
	2	N1	On		2	N1	Off
		N2	Off			N2	Off
		N3	Off			N3	Off
	3	N1	On		3	N1	Off
		N2	On			N2	Off
		N3	On			N3	Off
	4	N1	Off		4	N1	On

		N2	Off			N2	Off
		N3	Off			N3	Off
	5	N1	Off		5	N1	On
		N2	Off			N2	Off
		N3	Off			N3	Off
	6	N1	Off		6	N1	On
		N2	Off			N2	On
		N3	Off			N3	On

In case that an acceleration switch is made of a piezoelectric thin film group as shown in FIGS. 8 and 9, the piezoelectric film a3 is given the surface pressure of the steel ball B and generates a signal that is a voltage variation signal rather than an on/off signal. This signal corresponds to the intensity of acceleration applied to a thin film group.

FIG. 10 is a flowchart explaining one preferred embodiment of an acceleration sensing method according to the present invention. Referring to FIG. 10, for a human movement accuracy evaluation/movement analysis system (not shown), a motion sensor is fixed on a major body region of a model in step 100, and then, an acceleration signal generated by the motion sensor according to the movement of the model is wirelessly transmitted in step 110. After step

110, the wirelessly transmitted acceleration signal is received and recorded every hour in step 120, and then analyzed to determine a basic pattern of the movement of the model in step 130.

If the basic pattern of the movement is determined in step 130, a motion sensor is fixed on a main body region of a user in step 140, and then, an acceleration signal generated by the motion sensor according to the movement of the user is wirelessly transmitted in step 150.

After step 150, the wirelessly transmitted signal is received and recorded every hour in step 160. Next, the movement of the model is compared with that of the user in step 170, and movement/posture of the user to be corrected is determined based on the comparison result and correction thereof is carried out in step 180. After step 180, completion of the correction of the movement/posture of the user is checked in step 190. Thereafter, the method proceeds to step 140 if the correction is not carried out, otherwise all the procedures are terminated.

FIG. 11 is a flowchart explaining another preferred embodiment of an acceleration sensing method according to the present invention. Referring to FIG. 11, a motion sensor is fixed on a major body region of a user in step 200, and then, an acceleration signal generated by the motion sensor according to the user's movement is wirelessly transmitted in step 210. Next, the wirelessly transmitted acceleration signal is received in step 220, and then, a musical instrument digital interface (MIDI) protocol corresponding to the received signal is generated in step 230. After step 230, a MIDI sound is produced using the MIDI protocol and a sampling sound is produced in step 240.

If the wirelessly transmitted signal is received in step 220, a game system play control signal corresponding to the received signal is generated in step 250. Next, the related game is played in step 260. Otherwise, if the wirelessly transmitted signal is received in step 220, an illuminating/electronic apparatus control signal corresponding to the

received signal may be generated in step 270 and then, the related illuminating/electronic apparatus is actuated in step 280.

Industrial Applicability

In conclusion, an acceleration motion sensor and method of using the same according to the present invention have the following advantages. First, the motion sensors are fixed on body regions of a model and a user, acceleration caused by their movements are detected by the movement of the motion sensors, and the acceleration of the movements are converted into electric signals. Thus, a difference between the movements of the model and the user can be precisely sensed using a compact and light motion sensor. Secondly, the motion sensor is manufactured by arranging one of the respective conductive material-coated thin film groups and the piezoelectric thin film group at least once, thereby converting acceleration into a signal for each procedure. Lastly, these thin film groups are formed on each side of a polyhedral case, and thus, it is possible to measure acceleration in all directions.

While the present invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. An acceleration sensing apparatus including a polyhedral case having a steel ball therein, the apparatus comprising:

a first plate forming an outer side of the polyhedral case, the first plate whose inside is covered with a conductive material connected to the outside;

a first thin film positioned on the inside of the first plate, having a right side coated with a conductive material, and connected to the outside of the case by wire;

a second thin film positioned at the right side of the first thin film and having a hollow center;

a third thin film positioned at the right side of the second thin film, having both sides coated with a conductive material, and connected to the outside of the case by wire;

a fourth thin film positioned at the right side of the third thin film and having a hollow center;

a piezoelectric thin film positioned at the inside of the first plate and formed of a thin piezoelectric element; and

a fifth thin film positioned at the right side of the piezoelectric thin film and having a hollow center.

2. The apparatus of claim 1 comprising at least one conductive material-coated thin film group having the first through third thin films.

3. The apparatus of claim 2, wherein the conductive material-coated thin film group is arranged such that the first through third thin films overlap at least once.

4. The apparatus of claim 1 comprising one piezoelectric thin

film group having the piezoelectric film and the fifth thin film.

5. The apparatus of claim 4, wherein the piezoelectric device thin film group is arranged such that the piezoelectric film and the fifth thin film overlap at least once.

6. The apparatus of claim 2 or 4 comprising one of the conductive material-coated thin film group and the piezoelectric device thin film that can be attached to every side of a polyhedron.

7. The apparatus of claim 1, wherein the hollow centers of the second, fourth, and fifth thin films may be of to various shapes.

8. The apparatus of claim 2 or 4, wherein the conductive material-coated thin film group and the piezoelectric device thin film group are in an on/off-state or generate electric signals like voltage when surface pressure by the movement of the steel ball is applied to the groups.

9. The apparatus of claim 1, wherein the polyhedral case may be a tetrahedron, a hexahedron, or an octahedron.

10. The apparatus of claim 1, wherein the shape of the steel ball may be spherical, oval, or polyhedral.

11. The apparatus of claim 1, wherein the motion sensor comprises a mercury switch that is a bar-shaped tube or a polyhedral tube having at least two terminals.

12. An acceleration sensing method comprising:

fixing a motion sensor on a major body region of a model;

sensing an acceleration signal with respect to the movement of the model, using the motion sensor, and wirelessly transmitting the sensed acceleration signal;

receiving and recording the wirelessly transmitted acceleration signal every hour;

analyzing the recorded acceleration signal and determining a basic pattern of the movement of the model;

fixing a motion sensor on a major body region of a user;

receiving and recording an acceleration signal with respect to the movement of the user;

comparing the movement of the model with the movement of the user and analyzing a difference between the movements; and

determining and correcting the movement or posture of the user according to the comparison result.

13. An acceleration sensing method comprising:

fixing a motion sensor on a major body region of a user;

sensing an acceleration signal with respect to the movement of the user and wirelessly transmitting the sensed acceleration signal;

receiving the wirelessly transmitted acceleration signal, generating a musical instrument digital interface (MIDI) protocol corresponding to the acceleration signal, producing a game system play control signal, and producing an illuminating/electronic apparatus control signal; and

producing a MIDI electronic sound, or actuating a game system, or an illuminating/electronic apparatus in response to the produced control signal.

FIG. 1

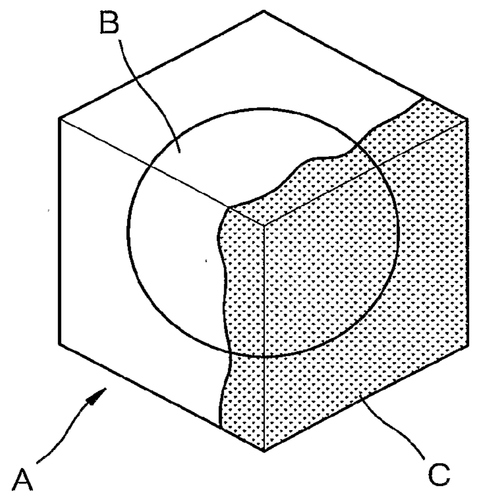


FIG. 2

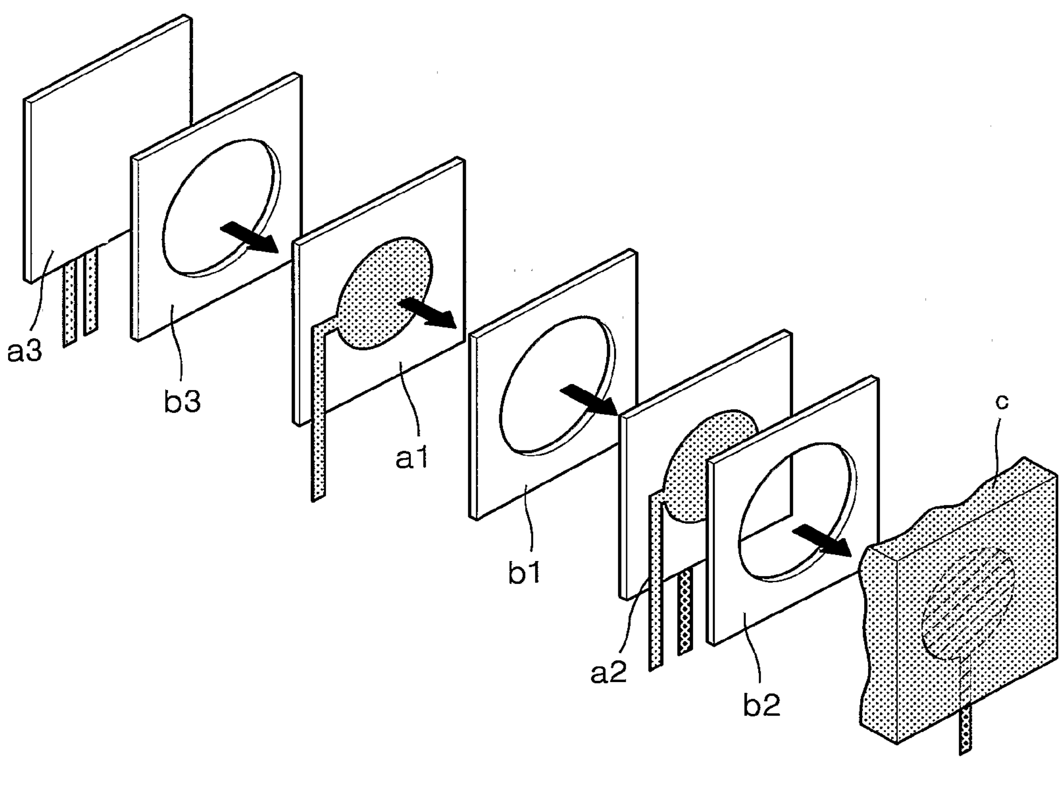


FIG. 3

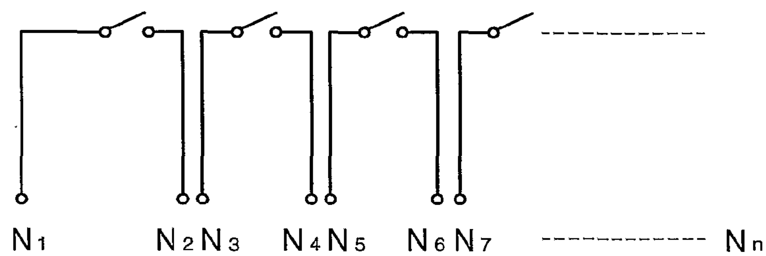


FIG. 4

(a)

(b)

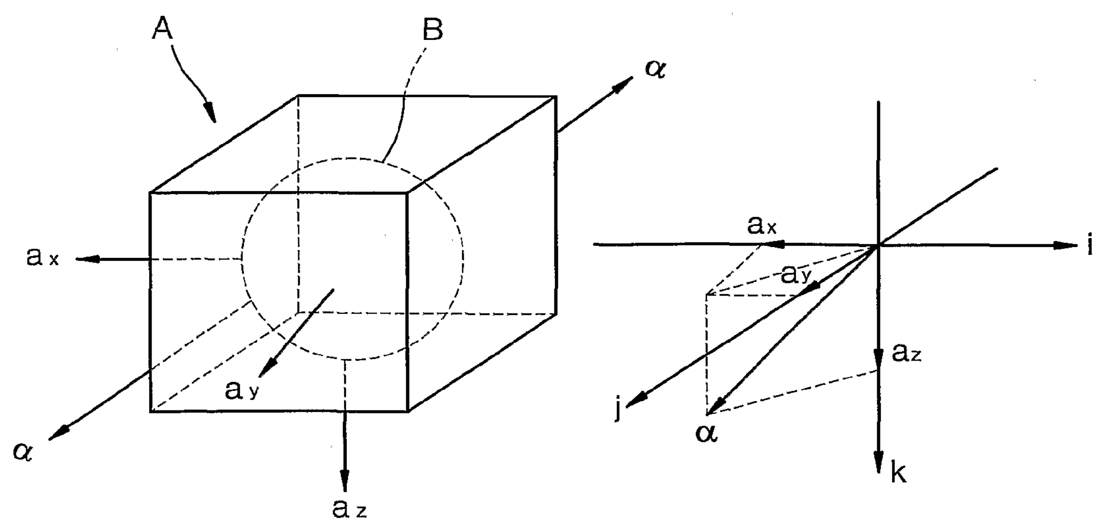


FIG. 5

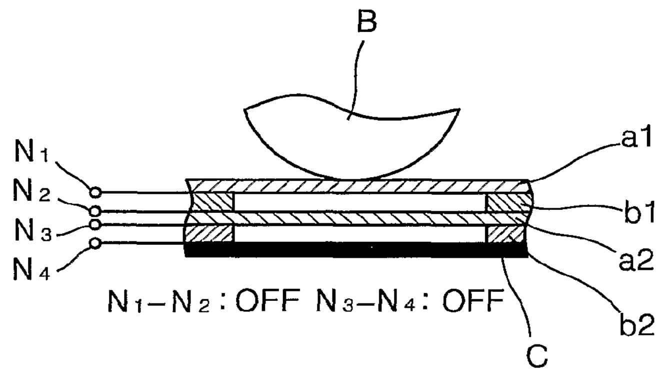


FIG. 6

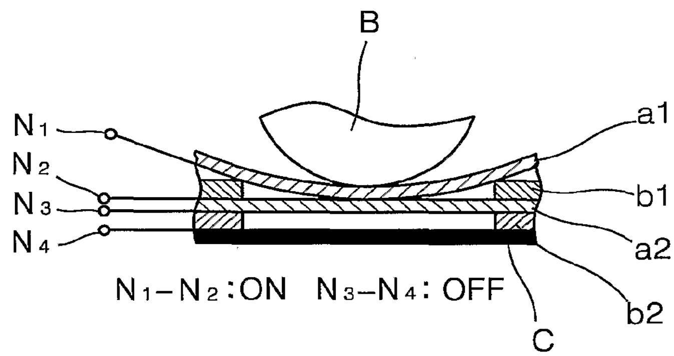


FIG. 7

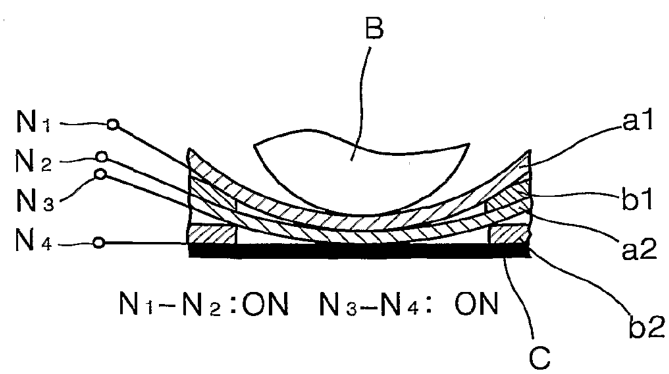


FIG. 8

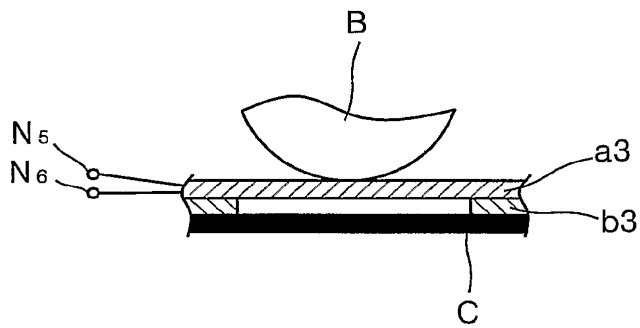


FIG. 9

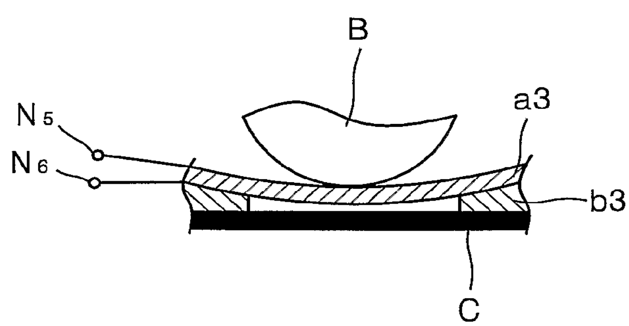


FIG. 10

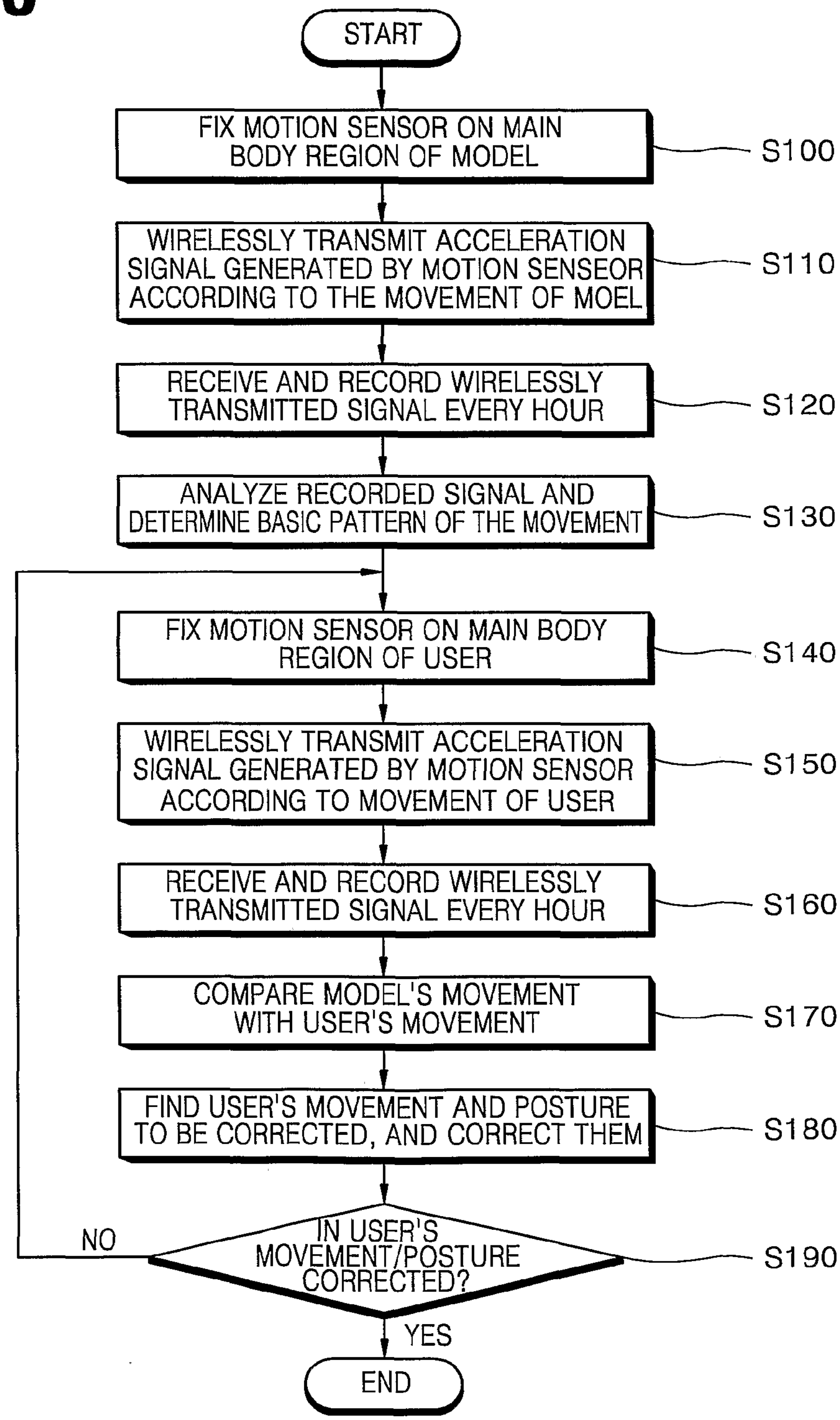
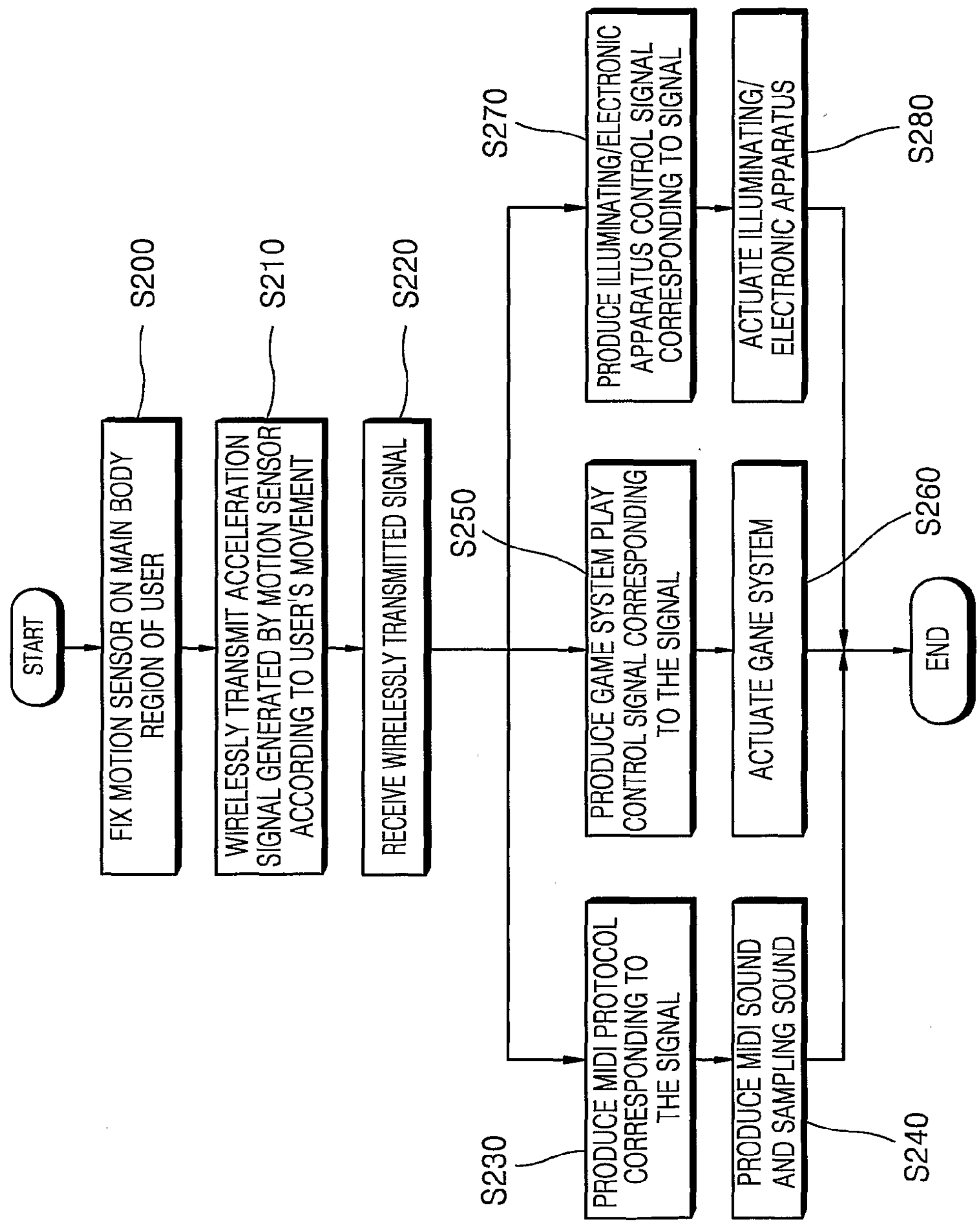

START
FIX MOTION SENSOR ON MAIN BODY REGION OF MODEL
S100
WIRELESSLY TRANSMIT ACCELERATION SIGNAL GENERATED BY MOTION SENSEOR ACCORDING TO THE MOVEMENT OF MOEL
S110
RECEIVE AND RECORD WIRELESSLY TRANSMITTED SIGNAL EVERY HOUR
S120
ANALYZE RECORDED SIGNAL AND DETERMINE BASIC PATTERN OF THE MOVEMENT
S130
FIX MOTION SENSOR ON MAIN BODY REGION OF USER
S140
WIRELESSLY TRANSMIT ACCELERATION SIGNAL GENERATED BY MOTION SENSOR ACCORDING TO MOVEMENT OF USER
S150
RECEIVE AND RECORD WIRELESSLY TRANSMITTED SIGNAL EVERY HOUR
S160
COMPARE MODEL'S MOVEMENT WITH USER'S MOVEMENT
S170
FIND USER'S MOVEMENT AND POSTURE TO BE CORRECTED, AND CORRECT THEM
S180
IN USER'S MOVEMENT/POSTURE CORRECTED?
S190
NO
YES
END

FIG. 11


START
FIX MOTION SENSOR ON MAIN BODY REGION OF USER
S200
WIRELESSLY TRANSMIT ACCELERATION SIGNAL GENERATED BY MOTION SENSOR ACCORDING TO USER'S MOVEMENT
S210
RECEIVE WIRELESSLY TRANSMITTED SIGNAL
S220
S230
PRODUCE MIDI PROTOCOL CORRESPONDING TO THE SIGNAL
PRODUCE MIDI SOUND AND SAMPLING SOUND
S240
S250
PRODUCE GAME SYSTEM PLAY CONTROL SIGNAL CORRESPONDING TO THE SIGNAL
ACTUATE GANE SYSTEM
S260
S270
PRODUCE ILLUMINATING/ELECTRONIC APPARATUS CONTROL SIGNAL CORRESPONDING TO SIGNAL
ACTUATE ILLUMINATING/ ELECTRONIC APPARATUS
S280
END

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR02/00736

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 G01P 15/09

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G01P, H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
KOREAN PATENT AND APPLICATIONS FOR INVENTIONS SINCE 1975
KOREAN UTILITY MODELS AND APPLICATIONS FOR UTILITY MODELS SINCE 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)
NPS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,496,352 A (Pacesetter, Inc.) 5 Mar. 1996(05.03.1996) See the abstract	1
A	JP 09304429 A(OMRON CORP.) 20 May 1996(20.05.1996) See the abstract	1
A	FR 2,755,765 A(BOUTET PAUL) 15 May 1998(15.05.1998) See the abstract	1

☐ Further documents are listed in the continuation of Box C.   ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevence
"E" earlier application or patent but published on or after the international filing date
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"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevence; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevence; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 AUGUST 2002 (16.08.2002)	16 AUGUST 2002 (16.08.2002)

Name and mailing address of the ISA/KR	Authorized officer
Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea	LEE, Soo Hee
Facsimile No. 82-42-472-7140	Telephone No. 82-42-481-5668